

## PATENT ABSTRACTS OF JAPAN

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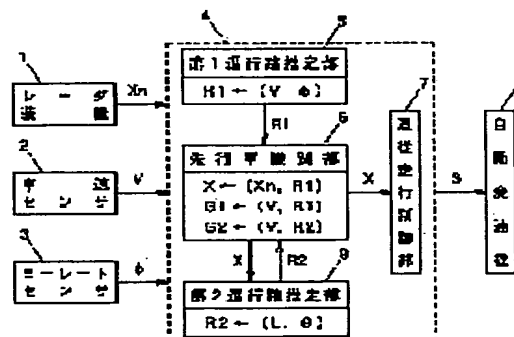
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## (54) OBSTACLE DETECTING DEVICE FOR VEHICLE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To suppress the misresetting of acquisition of a precedent vehicle due to vehicle body rolling at a low vehicle speed by restricting the resetting of acquisition of the body present which is nearest to this vehicle on the travel path when the vehicle speed of this vehicle is slower than a specific vehicle speed.

**SOLUTION:** This device is equipped with a scan type radar device 1 which scans a specific range in front of this vehicle with a radar wave and detects the position of a precedent travel vehicle from its reflected wave, a vehicle speed sensor 2 which detects the vehicle speed of this vehicle, and a yaw rate sensor 3 which detects the yaw rate generated by this vehicle, and their detection signals are inputted to a control unit 4. The travel path of this vehicle is estimated from the vehicle speed of this vehicle and the yaw rate generated by this vehicle to acquire the precedent vehicle which is nearest to this vehicle on the travel path of the this vehicle, and if the precedent vehicle deviates from the travel path of this vehicle, its acquisition is reset. Then when the vehicle speed of this vehicle is slower than the specific vehicle speed, this resetting of this acquisition is restricted. Consequently, the misresetting of the acquisition of the precedent vehicle at a low vehicle speed due to the large rolling of the vehicle body can be suppressed.



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CLAIMS

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[Claim(s)]

[Claim 1]Catch an object which exists near the self-vehicle most in the road [ self-vehicle advance ] which an object which exists ahead of a self-vehicle is detected, and is presumed based on a run state of a self-vehicle among these, and. A crossing obstructing detector of vehicles, wherein it has a prehension release control means which is a crossing obstructing detector of vehicles of which the prehension is canceled when this object deviates from the above-mentioned self-vehicle advance way, and regulates release of the above-mentioned prehension when the vehicle speed of a self-vehicle is lower than the predetermined vehicle speed.

[Claim 2]A crossing obstructing detector of the vehicles according to claim 1, wherein a prehension release control means regulates release of objective prehension only when a self-vehicle is slowing down even if it is it at the time when the vehicle speed of a self-vehicle is lower than the predetermined vehicle speed.

[Claim 3]A crossing obstructing detector of the vehicles according to claim 2, wherein a prehension release control means regulates release of objective prehension until a self-vehicle stops.

[Claim 4]A crossing obstructing detector of the vehicles according to any one of claims 1 to 3, wherein regulation of release of prehension of an object by a prehension release control means is prohibition of release of prehension.

[Claim 5]Catch an object which exists near the self-vehicle most in the road [ self-vehicle advance ] which an object which exists ahead of a self-vehicle is detected, and is presumed based on a run state of a self-vehicle among these, and. A crossing obstructing detector of vehicles, wherein it has an advance road width alteration means which is a crossing obstructing detector of vehicles of which the prehension is canceled when this object deviates from the above-mentioned self-vehicle advance way, and makes width of the above-mentioned self-vehicle advance way larger than the time when a direction when the vehicle speed of a self-vehicle is low is high.

[Claim 6]Catch an object which exists near the self-vehicle most in the road [ self-vehicle

advance ] which an object which exists ahead of a self-vehicle is detected, and is presumed based on a run state of a self-vehicle among these, and. When this object deviates from the above-mentioned self-vehicle advance way, A crossing obstructing detector of vehicles, wherein it has a prehension retention time alteration means which is a crossing obstructing detector of vehicles canceled after holding prehension of this object until predetermined time passes since that time of deviating, and makes retention time of the above-mentioned prehension longer than the time when a direction when the vehicle speed of a self-vehicle is low is high.

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention catches the object which exists most in the neighborhood by a self-vehicle advance on the street, and when this prehension object deviates from a self-vehicle advance way, it relates to the crossing obstructing detector of the vehicles of which that prehension is canceled.

[0002]

[Description of the Prior Art]Generally the crossing obstructing detector carried in vehicles, Detect objects, such as forward travel vehicles which exist ahead of a self-vehicle using a radar installation, and. The advance way the self-vehicle will run based on the run state of a self-vehicle is presumed, the forward travel vehicles which are in this self-vehicle advance on the street, and exist near the self-vehicle most are detected, and that position information is caught by making this into a preceded vehicle.

The position information on this caught preceded vehicle is used for the control in the case of avoiding the case where a flattery run is carried out, and a collision, etc., maintaining the fixed distance between two cars, for example to this preceded vehicle.

[0003]And generally, when a preceded vehicle deviates from a self-vehicle advance way, catch the vehicles which cancel the prehension and newly fulfill the above-mentioned conditions as a preceded vehicle, but. When a preceded vehicle still advances a straight-line road into a curve during a rectilinear-propagation run and a self-vehicle begins a turning travel now, Although this preceded vehicle is judged to have deviated from the self-vehicle advance way presumed by approximately linear shape based on the run state of a self-vehicle seemingly and is running the same lane, since the prehension will be canceled accidentally, Until predetermined time passes since that time of deviating as such a thing that copes with it inconvenient even if a preceded vehicle deviates from a self-vehicle advance way as indicated by JP,6-292729,A, For example, what still continued catching these vehicles as a preceded vehicle is known until the advance way where the self-vehicle

arrived at the point from which it deviated, and met the curve is presumed.

[0004]

[Problem(s) to be Solved by the Invention]By the way, a self-vehicle advance way substitutes for the following formula 1 the yaw rate  $\phi$  generated on the self-vehicle speed  $V$  and a self-vehicle, asks for the turning radius  $R$ , and is presumed by giving predetermined width (for example, width equivalent to breadth of a car) to the straight line or curve which has this turning radius  $R$  as indicated also in the above-mentioned gazette.

[0005]

[Formula 1]

$$R = V / \phi$$

According to this, since the yaw rate  $\phi$  becomes close to 0 at the time of a rectilinear-propagation run, the turning radius  $R$  becomes infinite, the self-vehicle advance way of approximately linear shape is presumed, and the advance way of the shape of a curve of the given curvature according to the yaw rate  $\phi$  generated on a self-vehicle is presumed at the time of a turning travel, for example.

[0006]However, at the time of the low vehicle speed, since body deflection is large compared with the time of the high vehicle speed, even if a yaw rate is changed, for example, it is running the straight-line road, a curve-like advance way is presumed, a preceded vehicle deviates from a self-vehicle advance way seemingly, and the problem that the prehension will be canceled accidentally arises.

[0007]Then, this invention copes with the above-mentioned problem in the conventional crossing obstructing detector, and offers a technical problem the crossing obstructing detector of the vehicles which can control incorrect release of prehension of the preceded vehicle by the body deflection at the time of the low vehicle speed.

[0008]

[Means for Solving the Problem]Namely, among this inventions the invention (henceforth "the 1st invention") according to claim 1, Catch an object which exists near the self-vehicle most in the road [ self-vehicle advance ] which an object which exists ahead of a self-vehicle is detected, and is presumed based on a run state of a self-vehicle among these, and. When this object deviates from the above-mentioned self-vehicle advance way, it has a prehension release control means which is a crossing obstructing detector of vehicles of which the prehension is canceled, and regulates release of the above-mentioned prehension when the vehicle speed of a self-vehicle is lower than the predetermined vehicle speed.

[0009]According to this 1st invention, body deflection is large, and since release of that prehension is regulated by prehension release control means even if an object caught till then deviates from a self-vehicle advance way at the time of the low vehicle speed a self-vehicle advance way is not correctly presumed to be, incorrect release of prehension is controlled by it.

[0010]And the invention (henceforth "the 2nd invention") according to claim 2, Even if it is a prehension release control means in the 1st invention of the above at the time when the vehicle speed of a self-vehicle is lower than the predetermined vehicle speed, Only when a self-vehicle is slowing down, it is characterized by regulating release of objective prehension, and further, the invention (henceforth "the 3rd invention") according to claim 3 regulates release of objective prehension until a self-vehicle stops a prehension release control means in this 2nd invention.

[0011]According to these 2nd and 3rd invention, since body stability falls and release of objective prehension is regulated at the time of a slowdown with a remarkable change of a yaw rate especially even if it is at the low vehicle speed time, a big effect about controlling incorrect release of prehension is acquired.

[0012]The invention (henceforth "the 4th invention") according to claim 4 is characterized by regulation of release of prehension of an object by a prehension release control means being prohibition of release of prehension in either the 1st invention of the above thru/or the 3rd invention.

[0013]Since release of objective prehension is forbidden according to this 4th invention, incorrect release of prehension is avoided.

[0014]It has an advance road width alteration means which the invention (henceforth "the 5th invention") according to claim 5 is a crossing obstructing detector of the same vehicles as the 1st invention of the above, and, on the other hand, makes width of a self-vehicle advance way larger than the time when a direction when the vehicle speed of a self-vehicle is low is high.

[0015]According to this 5th invention, body deflection is large, since width of this advance way is made larger than the time of the high vehicle speed by advance road width alteration means for a direction at the time of the low vehicle speed a self-vehicle advance way is not correctly presumed to be, that an object deviates from a self-vehicle advance way decreases, and incorrect release of prehension is controlled by it.

[0016]And the invention (henceforth "the 6th invention") according to claim 6, It is a crossing obstructing detector of vehicles canceled after holding prehension of this object until predetermined time passes since that time of deviating even if a prehension object deviates from a self-vehicle advance way, It has a prehension retention time alteration means which makes retention time of the above-mentioned prehension longer than the time when a direction when the vehicle speed of a self-vehicle is low is high.

[0017]According to this 6th invention, body deflection is large, and since retention time of prehension of this object from a time at which a prehension object deviated from a self-vehicle advance way rather than the time of the high vehicle speed in a direction at the time of the low vehicle speed a self-vehicle advance way is not correctly presumed to be is lengthened by prehension retention time alteration means, incorrect release of prehension is controlled by it.

[0018]

[Embodiment of the Invention] Hereafter, an embodiment of the invention is described based on a drawing.

[0019] As shown in drawing 1, on the vehicles in this embodiment. The scan type radar installation 1 which scans and sends a radar wave ahead [ of a self-vehicle ] within the limits of predetermined, and detects the position of forward travel vehicles from the reflected wave, It has the speed sensor 2 which detects the vehicle speed of a self-vehicle, and the yaw rate sensor 3 which detects the yaw rate generated on a self-vehicle, and these detecting signals are inputted into the control unit 4.

[0020] The 1st advance way estimating part 5 which computes the turning radius R1 of the 1st advance way of a self-vehicle in this control unit 4 by substituting the above-mentioned vehicle speed V and the yaw rate phi for the above-mentioned formula 1, It has the preceded vehicle identification part 6 which identifies the forward travel vehicles which are in this 1st advance on the street based on each position information Xn and the above-mentioned 1st advance way of forward travel vehicles, and exist near the self-vehicle most as the preceded vehicle X, In response to the position information about this preceded vehicle X, the shift control signals S are outputted to the automatic transmission 8 from the tracking-travel-control part 7, and a flattery run is carried out to the above-mentioned preceded vehicle.

[0021] The position information on the preceded vehicle X is outputted also to the 2nd advance way estimating part 9, and as shown in drawing 2, based on the distance L and the angle theta of the self-vehicle A and the preceded vehicle X, the turning radius R2 of the 2nd advance way (a shown with a dashed line among drawing 2) of a self-vehicle is computed by the following formula 2.

[0022]

[Formula 2]

$$R2 = L / 2 \cdot \sin \theta$$

The preceded vehicle identification part 6 computes the 1st and 2nd lateral acceleration G1 and G2 which are generated when a self-vehicle runs along these advance ways based on the vehicle speed V and the above 1st, the turning radius R1 of the 2nd advance way, and R2 with the following formulas 3 and 4.

[0023]

[Formula 3]

$$G1 = V^2 / R1$$

[0024]

[Formula 4]

$$G2 = V^2 / R2$$

therefore -- when a preceded vehicle is in in the road [ 1st advance ] it is presumed based on the run state of a self-vehicle, the 2nd advance way is in agreement with the 1st

advance way -- the 1st and 2nd lateral acceleration  $G1$  and  $G2$  -- abbreviated, although it becomes the same value, When a preceded vehicle deviates from the 1st advance way, a significant difference will appear between the 1st and 2nd lateral acceleration  $G1$  and  $G2$ . [0025] Hereafter, the tracking travel control (lock on control) to the preceded vehicle which the control unit 4 performs is explained according to the flow chart shown in drawing 3, using these computed results.

[0026] Although it judges first whether the lock on flag  $Lckf$  is 0 at Step S1, this lock on flag  $Lckf$  is status flags which are set to 1 when having caught the preceded vehicle which is the target of a flattery run, and are set to 0 when not having caught.

[0027] And when not having caught the preceded vehicle at present, it progresses to Step S2, It is judged whether the time  $T$  from the time at which the vehicles which should serve as a preceded vehicle detected now were detected first exceeded the predetermined time  $T_0$ , The lock on flag  $Lckf$  is set to one at Step S3 at the time of YES, and it progresses to Step S12, and it progresses to Step S12 at the time of NO, setting the lock on flag  $Lckf$  to zero.

[0028] On the other hand, when having caught the preceded vehicle, progress to step S4, judge whether the self-vehicle speed  $V$  is lower than the low vehicle speed  $V_0$  which is presumed by the 1st advance way shifting for body deflection, and At the time of NO. At Step S5, body deflection is small at the time of the high vehicle speed, when the 1st advance way is presumed correctly, reset the timer  $t$  of prehension retention time, and At that is, the time of YES. That is, body deflection is large at the time of the low vehicle speed, and when the 1st advance way shifts and is presumed, the above-mentioned timer  $t$  is \*\*\*\*\*ed at Step S6.

[0029] Subsequently, after computing the 1st and 2nd lateral acceleration  $G1$  and the difference  $d$  of  $G2$  in Step S7 at the time of the high vehicle speed, it is judged at Step S8 whether this difference  $d$  is larger than  $0.2g$  ( $g$  is gravitational acceleration), The lock on flag  $Lckf$  is set to zero by step S9 at the time of YES, and it progresses to Step S12, and it progresses to Step S12 at the time of NO, setting the lock on flag  $Lckf$  to one.

[0030] Here,  $0.2g$  which is a judging standard is the maximum of the lateral acceleration generated on vehicles, when a steady turning run is carried out along with the curve generally designed on a highway etc. A self-vehicle is still rectilinear-propagation running [ be / that is, ] a straight-line road (at this time, the turning radius  $R1$  is infinite and). The lateral acceleration  $G1$  is the formulas 3-0. In the case where a preceded vehicle advances into a curve and begins to carry out the steady turning run of the same lane, Since the 1st and 2nd lateral acceleration  $G1$  and the difference  $d$  of  $G2$  must be  $0.2g$  or less, As opposed to maintaining the lock on flag  $Lckf$  to one that these vehicles should be made into a preceded vehicle and should still be caught even if this preceded vehicle has deviated from the 1st advance way, The 1st and 2nd lateral acceleration  $G1$  and the difference  $d$  of  $G2$  when larger than  $0.2g$ , Since the preceded vehicle shows that the lane change etc. were performed and the turning radius  $R2$  of the 2nd advance way became smaller than



the turning radius of a curve, it is not necessary to catch these vehicles as a preceded vehicle, and the lock on flag Lckf is returned to zero.

[0031]On the other hand, it is judged whether in Step S10, the timer t of prehension retention time exceeded the predetermined time to at the time of the low vehicle speed, The lock on flag Lckf is set to zero at Step S11, and the above-mentioned timer t is reset at the time of YES, it progresses to Step S12, and he follows it to Step S12 at the time of NO, without performing these.

[0032]Here, the predetermined time to which is a judging standard of a timer is time since the self-vehicle speed V became lower than the above-mentioned predetermined vehicle speed Vo, until a self-vehicle stops, and is computed by the following formula 5 based on the vehicle speed V and the deceleration alpha.

[0033]

[Formula 5]

$$t_o = V / \alpha$$

Namely, since body deflection becomes large, the 1st advance way will shift, and will be presumed and prehension of a preceded vehicle will be accidentally canceled as a result if the self-vehicle speed V becomes lower than the above-mentioned predetermined vehicle speed Vo, The lock on flag Lckf is maintained to one that catching the preceded vehicle caught till then should be continued, and when a self-vehicle stops, the lock on flag Lckf is set to zero that the prehension should be canceled for the first time, until a self-vehicle stops.

[0034]And after passing through such a judgment routine in any case, it is judged at Step S12 whether the lock on flag Lckf is 1, It progresses to Step S13 at the time of 1, maintaining the fixed distance between two cars to this preceded vehicle based on the position information on the preceded vehicle which has performed namely, caught lock on, the shift signal S is outputted to the automatic transmission 8 so that a flattery run may be carried out, it progresses to Step S14 at the time of 0, and it cancels lock on.

[0035]According to this, when continuing detecting first the vehicles which should serve as a preceded vehicle exceeding the predetermined time To, the lock on flag Lckf is set to one, and the flattery run to this preceded vehicle is started, While the self-vehicle is running with the high vehicle speed comparatively after that, a flattery run is continued except for the case where the 1st and 2nd lateral acceleration G1 and the difference d of G2 become larger than 0.2 g.

[0036]And even when the self-vehicle speed V becomes lower than the predetermined vehicle speed Vo and the 1st advance way is no longer correctly presumed for big body deflection, prehension of the above-mentioned preceded vehicle will be held until a self-vehicle stops, and it will continue lock on. Therefore, even if the preceded vehicle caught till then deviates from the 1st advance way seemingly, it is lost that the prehension is canceled accidentally.

[0037]Next, a 2nd embodiment of this invention is described.

[0038]As shown in drawing 4, also in the vehicles in this embodiment, it has scan type radar installation 21, speed sensor 22, and yaw rate sensor 23 like the above-mentioned, Each of these detecting signals  $X_n$ ,  $V$ , and  $\phi$  are inputted into the control unit 24, The self-vehicle advance way which has the turning radius  $R$  is presumed by the advance way estimating part 25, the preceded vehicle  $X$  is further identified by the preceded vehicle identification part 26, and the shift control signals  $S$  of the flattery run to this preceded vehicle  $X$  are outputted to the automatic transmission 28 via the tracking-travel-control part 27.

[0039]And in these vehicles, the width of the self-vehicle advance way presumed by the advance way estimating part 25 is changed according to the vehicle speed  $V$ . Hereafter, this advance road width change control is explained according to the flow chart shown in drawing 5.

[0040]After reading the self-vehicle speed  $V$  at Step S21 first, when judging whether the lock on flag  $Lckf$  is 0 at Step S22 and not having caught the preceded vehicle at present, it shall progress to Step S23, and the advance road width  $W$  shall be 2 meters, and a self-vehicle advance way is created. This width of 2 meters is the width of the minimum which hits presuming an advance way effectively by being equivalent to breadth of a car about. Therefore, while not having caught the preceded vehicle, the self-vehicle advance on the street of this 2-meter width will be asked for the preceded vehicle  $X$ .

[0041]On the other hand, when having caught the preceded vehicle, it progresses to Step S24, and the self-vehicle speed  $V$  is applied to the map shown in drawing 6, and a self-vehicle advance way is created by making corresponding value  $f(V)$  into the advance road width  $W$ . In that case, when the vehicle speed  $V$  is not less than 60 km/h, it is considered as 2 meters of minimum width, below, 20 km/h becomes large as the vehicle speed  $V$  becomes low, and value-of-a-function  $f(V)$  is set as 4 meters at 20 km/h or less. This width of 4 meters is the width of the maximum which hits presuming an advance way effectively by being equivalent to lane width about.

[0042]Therefore, it receives canceling the prehension, when the preceded vehicle is caught, and the preceded vehicle  $X$  deviates from the self-vehicle advance way of 2-meter width, while the self-vehicle is running with the vehicle speed of not less than 60 km/h, If the vehicle speed will be 60 km/h or less, the self-vehicle advance way of such wide width that the vehicle speed becomes low is created, and the prehension will be canceled when the preceded vehicle  $X$  deviates from the self-vehicle advance way which has a width of 4 meters which is equivalent to lane width when the self-vehicle speed is 20 km/h or less. As a result, since that a preceded vehicle deviates from a presumed advance way decreases at the time of the low vehicle speed to which body deflection becomes large and the error of the turning radius of a presumed advance way becomes large, it will be controlled that the prehension is canceled accidentally.

[0043]Value-of-a-function  $f(V)$  may be set up in the map of the advance road width shown

in drawing 6 change to step form besides what changes to linearity to the vehicle speed V.  
[0044]

[Effect of the Invention]As explained above, since body deflection is large, and release of prehension of the preceded vehicle caught till then is regulated at the time of the low vehicle speed presumed by a self-vehicle advance way shifting or an advance road width is made large, incorrect release of prehension of a preceded vehicle can be controlled with the crossing obstructing detector of the vehicles of this invention.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a control system figure of the vehicles in a 1st embodiment of this invention.

[Drawing 2]It is an explanatory view of the control which the preceded vehicle identification part of the above-mentioned vehicles performs.

[Drawing 3]It is a flow chart figure of lock on control of the above-mentioned vehicles.

[Drawing 4]It is a control system figure of the vehicles in a 2nd embodiment of this invention.

[Drawing 5]It is a flow chart figure of advance road width change control of the above-mentioned vehicles.

[Drawing 6]It is a map chart of an advance road width used by the above-mentioned control.

[Description of Notations]

- 1, 21 radar installations
- 2, 22 speed sensors
- 3 and 23 Yaw rate sensor
- 5 The 1st advance way estimating part
- 6 and 26 Preceded vehicle identification part
- 24 Advance way estimating part

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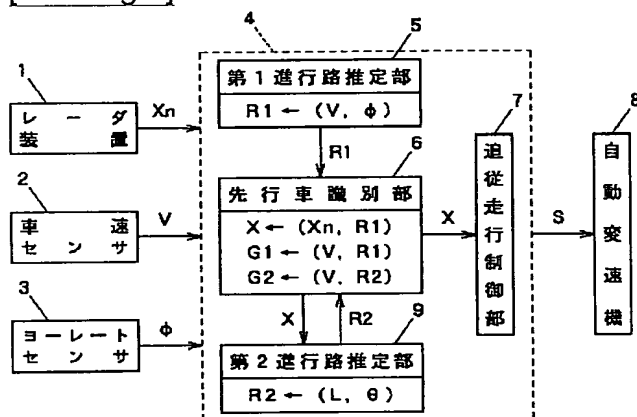
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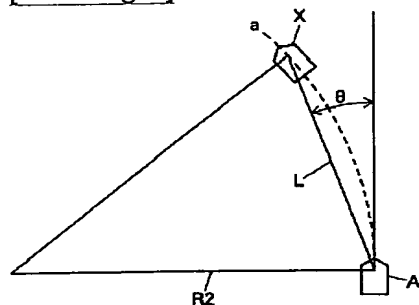
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## DRAWINGS

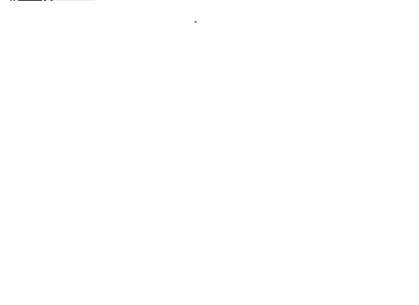
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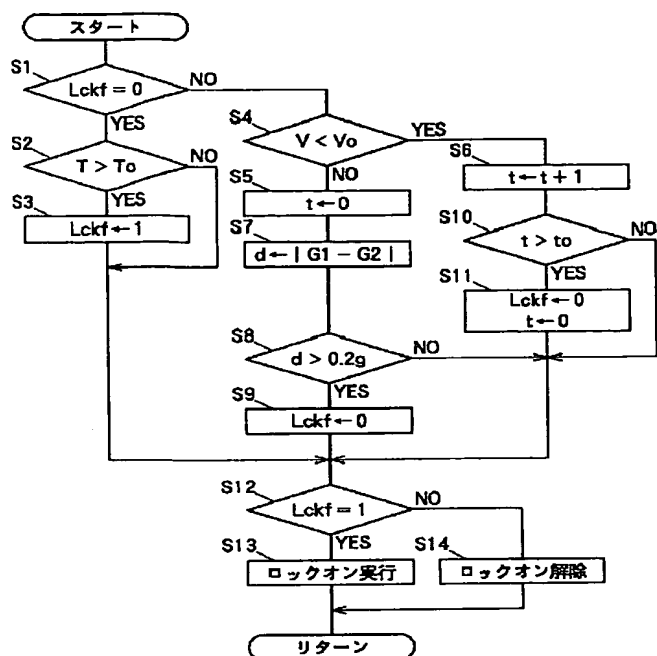


[Drawing 2]

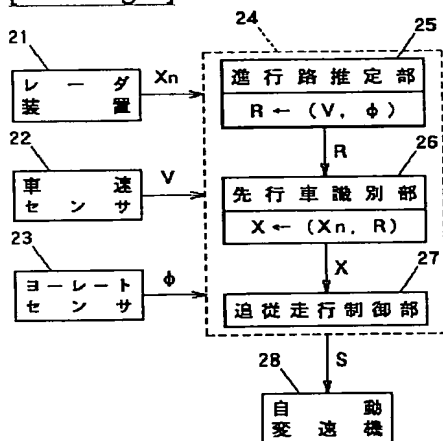


[Drawing 3]

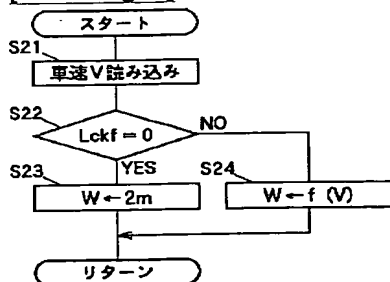




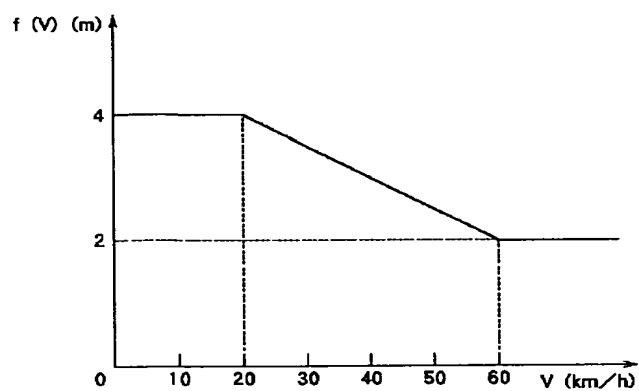
[Drawing 4]



[Drawing 5]



[Drawing 6]



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[Translation done.]

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(12) 公開特許公報 (A)

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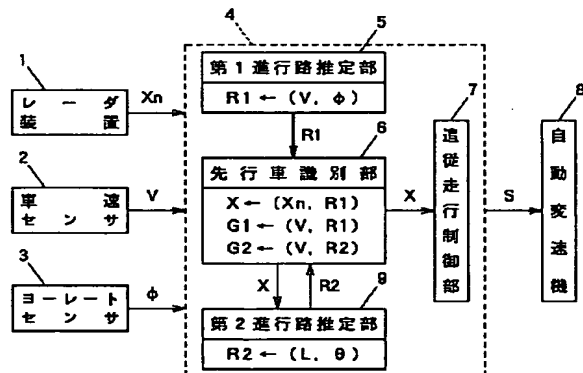
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(54) 【発明の名称】 車両の障害物検知装置

(57) 【要約】

【課題】 自車の前方走行車両のうち自車の走行状態に基づいて推定される自車進行路上で最も近くに存在するものを先行車としてその動きを捕捉し、該先行車が自車進行路から逸脱したときはその捕捉を解除するように構成された車両の障害物検知装置において、低車速時の車体振れにより自車進行路がずれて推定された場合に発生する先行車の捕捉の誤解除を抑制することを課題とする。

【解決手段】 車速センサ2で自車速を検出し、該自車速が所定の車速より低くなれば、それまで捕捉していた先行車の捕捉を所定時間保持し続けるように構成する。





## 【特許請求の範囲】

【請求項1】 自車の前方に存在する物体を検出し、これらのうち自車の走行状態に基づいて推定される自車進行路上で最も自車の近くに存在する物体を捕捉すると共に、該物体が上記自車進行路から逸脱したときはその捕捉を解除する車両の障害物検知装置であって、自車の車速が所定の車速より低いときには上記捕捉の解除を規制する捕捉解除規制手段が備えられていることを特徴とする車両の障害物検知装置。

【請求項2】 捕捉解除規制手段は、自車の車速が所定の車速より低いときであっても、自車が減速している場合にのみ物体の捕捉の解除を規制することを特徴とする請求項1に記載の車両の障害物検知装置。

【請求項3】 捕捉解除規制手段は、自車が停止するまで物体の捕捉の解除を規制することを特徴とする請求項2に記載の車両の障害物検知装置。

【請求項4】 捕捉解除規制手段による物体の捕捉の解除の規制は、捕捉の解除の禁止であることを特徴とする請求項1ないし請求項3のいずれかに記載の車両の障害物検知装置。

【請求項5】 自車の前方に存在する物体を検出し、これらのうち自車の走行状態に基づいて推定される自車進行路上で最も自車の近くに存在する物体を捕捉すると共に、該物体が上記自車進行路から逸脱したときは、その捕捉を解除する車両の障害物検知装置であって、自車の車速が低いときの方が高いときよりも上記自車進行路の幅を広くする進行路幅変更手段が備えられていることを特徴とする車両の障害物検知装置。

【請求項6】 自車の前方に存在する物体を検出し、これらのうち自車の走行状態に基づいて推定される自車進行路上で最も自車の近くに存在する物体を捕捉すると共に、該物体が上記自車進行路から逸脱したときは、その逸脱した時から所定の時間が経過するまで該物体の捕捉を保持したのち解除する車両の障害物検知装置であって、自車の車速が低いときの方が高いときよりも上記捕捉の保持時間を長くする捕捉保持時間変更手段が備えられていることを特徴とする車両の障害物検知装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、自車進行路上で最も近くに存在する物体を捕捉すると共に、この捕捉物体が自車進行路から逸脱したときはその捕捉を解除する車両の障害物検知装置に関する。

## 【0002】

【従来の技術】一般に、車両に搭載される障害物検知装置は、レーダ装置を用いて自車の前方に存在する前方走行車両等の物体を検出すると共に、自車の走行状態に基づいて自車が走行するであろう進行路を推定して、この自車進行路上にあって最も自車の近くに存在する前方走行車両を検知し、これを先行車としてその位置情報を捕

捉していくものであり、この捕捉された先行車の位置情報は、例えば該先行車に対して一定の車間距離を保ちながら追従走行をする場合や衝突を回避する場合の制御等に利用される。

【0003】そして、一般には、先行車が自車進行路から逸脱したときは、その捕捉を解除して新たに上記条件を満たす車両を先行車として捕捉するのであるが、これでは自車がまだ直線道路を直進走行中に先行車がカーブに進入して旋回走行を始めた場合に、該先行車が自車の走行状態に基づいて略直線状に推定される自車進行路から見掛け上逸脱したものと判断されて、同じ車線を走行しているにも拘らずその捕捉が誤って解除されることになるので、このような不都合に対処するものとして、特開平6-292729号公報に開示されているように、先行車が自車進行路から逸脱しても、その逸脱した時から所定の時間が経過するまで、例えば自車がその逸脱した地点に到達してカーブに沿った進行路が推定されるまでは、該車両を依然先行車として捕捉し続けるようにしたものも知られている。

## 【0004】

【発明が解決しようとする課題】ところで、上記公報にも記載されているように、自車進行路は、自車速 $V$ 及び自車に発生するヨーレート $\phi$ を次式1に代入して旋回半径 $R$ を求め、この旋回半径 $R$ を有する直線又は曲線に所定の幅（例えば車幅に相当する幅）をもたせることにより推定される。

## 【0005】

## 【式1】

$$R = V / \phi$$

これによれば、例えば直進走行時はヨーレート $\phi$ が0に近くなるので旋回半径 $R$ が無限大となって略直線状の自車進行路が推定され、また旋回走行時は自車に発生するヨーレート $\phi$ に応じた所定曲率の曲線状の進行路が推定される。

【0006】しかしながら、低車速時は高車速時に比べて車体振れが大きいためヨーレートが変動し、例えば直線道路を走行していても曲線状の進行路が推定されて、先行車が見掛け上自車進行路から逸脱し、その捕捉が誤って解除されてしまうという問題が生じる。

【0007】そこで、本発明は、従来の障害物検知装置における上記問題に対処するもので、低車速時の車体振れによる先行車の捕捉の誤解除を抑制し得る車両の障害物検知装置の提供を課題とする。

## 【0008】

【課題を解決するための手段】すなわち、本発明のうち請求項1に記載の発明（以下「第1発明」という。）

は、自車の前方に存在する物体を検出し、これらのうち自車の走行状態に基づいて推定される自車進行路上で最も自車の近くに存在する物体を捕捉すると共に、該物体が上記自車進行路から逸脱したときはその捕捉を解除す

る車両の障害物検知装置であって、自車の車速が所定の車速より低いときには上記捕捉の解除を規制する捕捉解除規制手段が備えられていることを特徴とする。

【0009】この第1発明によれば、捕捉解除規制手段によって、車体振れが大きく、自車進行路が正しく推定されない低車速時には、それまで捕捉していた物体が自車進行路から逸脱しても、その捕捉の解除が規制されるので、捕捉の誤解除が抑制される。

【0010】そして、請求項2に記載の発明（以下「第2発明」という。）は、上記第1発明において捕捉解除規制手段は、自車の車速が所定の車速より低いときであっても、自車が減速している場合にのみ物体の捕捉の解除を規制することを特徴とし、さらに請求項3に記載の発明（以下「第3発明」という。）は、この第2発明において捕捉解除規制手段は、自車が停止するまで物体の捕捉の解除を規制することを特徴とする。

【0011】これらの第2、第3発明によれば、低車速時であっても特に車体安定性が低下してヨーレートの変動が著しい減速時に物体の捕捉の解除が規制されるので、捕捉の誤解除を抑制することについて大きな効果が得られる。

【0012】また、請求項4に記載の発明（以下「第4発明」という。）は、上記第1発明ないし第3発明のいずれかにおいて捕捉解除規制手段による物体の捕捉の解除の規制は、捕捉の解除の禁止であることを特徴とする。

【0013】この第4発明によれば、物体の捕捉の解除が禁止されるので、捕捉の誤解除が回避される。

【0014】一方、請求項5に記載の発明（以下「第5発明」という。）は、上記第1発明と同様の車両の障害物検知装置であって、自車の車速が低いときの方が高いときよりも自車進行路の幅を広くする進行路幅変更手段が備えられていることを特徴とする。

【0015】この第5発明によれば、進行路幅変更手段によって、車体振れが大きく、自車進行路が正しく推定されない低車速時の方が高車速時よりも該進行路の幅が広くされるので、物体が自車進行路から逸脱することが少なくなり、捕捉の誤解除が抑制される。

【0016】そして、請求項6に記載の発明（以下「第6発明」という。）は、捕捉物体が自車進行路から逸脱しても、その逸脱した時から所定の時間が経過するまで該物体の捕捉を保持したのち解除する車両の障害物検知装置であって、自車の車速が低いときの方が高いときよりも上記捕捉の保持時間を長くする捕捉保持時間変更手段が備えられていることを特徴とする。

【0017】この第6発明によれば、捕捉保持時間変更手段によって、車体振れが大きく、自車進行路が正しく推定されない低車速時の方が高車速時よりも捕捉物体が自車進行路から逸脱した時からの該物体の捕捉の保持時間が長くされるので、捕捉の誤解除が抑制される。

【0018】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づき説明する。

【0019】図1に示すように、この実施の形態における車両には、自車の前方に所定の範囲内でレーダ波を走査、発信してその反射波から前方走行車両の位置を検出するスキャン式のレーダ装置1と、自車の車速を検出する車速センサ2と、自車に発生するヨーレートを検出するヨーレートセンサ3とが備えられて、これらの検出信号がコントロールユニット4に入力されるようになって

いる。

【0020】このコントロールユニット4には、上記車速V及びヨーレート $\phi$ を前述の式1に代入して自車の第1の進行路の旋回半径R1を算出する第1進行路推定部5と、前方走行車両の各位置情報Xn及び上記第1進行路に基づいて該第1進行路上にあって最も自車の近くに存在する前方走行車両を先行車Xとして識別する先行車識別部6とが備えられて、この先行車Xに関する位置情報を受けて追従走行制御部7から変速制御信号Sが自動変速機8に出力され、上記先行車に対して追従走行をするようになっている。

【0021】また、先行車Xの位置情報は第2進行路推定部9にも出力されて、図2に示すように自車Aと先行車Xとの距離L及び角度 $\theta$ に基づいて次式2により自車の第2の進行路（図2中、破線で示すa）の旋回半径R2が算出される。

【0022】

【式2】

$$R2 = L / 2 \cdot \sin \theta$$

さらに、先行車識別部6は、車速V及び上記第1、第2の進行路の旋回半径R1、R2に基づいて次式3、4により自車がこれらの進行路に沿って走行した場合に発生する第1、第2の横加速度G1、G2を算出するようになっている。

【0023】

【式3】

$$G1 = V^2 / R1$$

【0024】

【式4】

$$G2 = V^2 / R2$$

したがって、先行車が自車の走行状態に基づいて推定される第1進行路上にある場合は第2進行路が第1進行路と一致し、第1、第2の横加速度G1、G2が略同じ値となるが、先行車が第1進行路から逸脱したときは第1、第2の横加速度G1、G2間に有意差が現れることになる。

【0025】以下、これらの算出結果等を用いながらコントロールユニット4が行なう先行車に対する追従走行制御（ロックオン制御）を図3に示すフローチャートに従って説明する。

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【0026】まずステップS1でロックオンフラグL c k fが0か否かを判定するのであるが、このロックオンフラグL c k fは追従走行の対象となる先行車を捕捉しているときは1、捕捉していないときは0にされる状態フラグである。

【0027】そして、現在のところ先行車を捕捉していないときはステップS2に進んで、いま検知している先行車となるべき車両を最初に検知した時からの時間Tが所定の時間T oを超えたか否かを判定して、YESのときはステップS3でロックオンフラグL c k fを1にしてステップS12に進み、NOのときはロックオンフラグL c k fを0としたままでステップS12に進む。

【0028】一方、先行車を捕捉しているときはステップS4に進んで、自車速Vが車体振れのために第1進行路がずれて推定されるような低い車速V oより低いかなかを判定して、NOのとき、つまり高車速時に車体振れが小さく、第1進行路が正しく推定されるときはステップS5で捕捉保持時間のタイマーtをリセットし、YESのとき、つまり低車速時に車体振れが大きくなり、第1進行路がずれて推定されるときはステップS6で上記タイマーtをインクリメントする。

【0029】次いで、高車速時はステップS7において第1、第2の横加速度G1、G2の差dを算出したのち、ステップS8でこの差dが0.2g (gは重力加速度)より大きいかなかを判定して、YESのときはステップS9でロックオンフラグL c k fを0にしてステップS12に進み、NOのときはロックオンフラグL c k fを1としたままでステップS12に進む。

【0030】ここで、判定基準である0.2gは、一般に高速道路等で設計されるカーブに沿って定常旋回走行した場合に車両に発生する横加速度の最大値である。すなわち、自車がまだ直線道路を直進走行中(このとき旋回半径R1は無限度で、横加速度G1は式3から0である。)に先行車がカーブに進入して同じ車線を定常旋回走行し始めた場合においては、第1、第2の横加速度G1、G2の差dは0.2g以下のはずであるので、該先行車が第1進行路から逸脱していても依然この車両を先行車として捕捉すべくロックオンフラグL c k fを1に維持するのに対して、第1、第2の横加速度G1、G2の差dが0.2gより大きいときは、先行車が車線変更等を行なって第2進行路の旋回半径R2がカーブの旋回半径よりも小さくなったことを示しているので、この車両を先行車として捕捉する必要はなくロックオンフラグL c k fを0に戻すのである。

【0031】一方、低車速時はステップS10において捕捉保持時間のタイマーtが所定の時間t oを超えたかなかを判定して、YESのときはステップS11でロックオンフラグL c k fを0にすると共に上記タイマーtをリセットしてステップS12に進み、NOのときはこれらを行わずにステップS12に進む。

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【0032】ここで、タイマーの判定基準である所定時間t oは、自車速Vが上記所定車速V oより低くなった時から自車が停止するまでの時間であり、車速V及び減速度αに基づいて次式5により算出される。

【0033】

【式5】

$$t_o = V / \alpha$$

すなわち、自車速Vが上記所定車速V oより低くなれば車体振れが大きくなって第1進行路がずれて推定され、その結果先行車の捕捉が誤って解除されるので、自車が停止するまでは、それまで捕捉してきた先行車を捕捉し続けるべくロックオンフラグL c k fを1に維持し、自車が停止した時点で初めてその捕捉を解除すべくロックオンフラグL c k fを0とするのである。

【0034】そして、いずれの場合もこのような判定ルーチンを経たのちステップS12でロックオンフラグL c k fが1か否かを判定して、1のときはステップS13に進んでロックオンの実行、すなわち捕捉している先行車の位置情報に基づいて該先行車に対して一定の車間距離を保ちながら追従走行をするように自動変速機8に変速信号Sを出力し、0のときはステップS14に進んでロックオンを解除する。

【0035】これによれば、まず最初に、先行車となるべき車両を所定時間T oを超えて検知し続けたときにロックオンフラグL c k fが1とされて該先行車に対する追従走行が開始され、その後自車が比較的高車速で走行しているあいだは、第1、第2の横加速度G1、G2の差dが0.2gより大きくなった場合を除き、追従走行が続行される。

【0036】そして、自車速Vが所定車速V oより低くなり、大きな車体振れのために第1進行路が正しく推定されなくなったときでも、自車が停止するまでは上記先行車の捕捉が保持されて、ロックオンが続行されることになる。したがって、それまで捕捉していた先行車が第1進行路から見掛け上逸脱してもその捕捉が誤って解除されることがなくなる。

【0037】次に、本発明の第2の実施の形態について説明する。

【0038】図4に示すように、この実施の形態における車両においても前述と同様にスキャン式のレーダ装置21、車速センサ22及びヨーレートセンサ23が備えられ、これらの各検出信号Xn、V、φがコントロールユニット24に入力されて、旋回半径Rを有する自車進行路が進行路推定部25で推定され、さらに先行車Xが先行車識別部26で識別されて、この先行車Xに対する追従走行の変速制御信号Sが追従走行制御部27を介して自動変速機28に出力されるようになっている。

【0039】そして、この車両においては、進行路推定部25で推定される自車進行路の幅が車速Vに応じて変更されるようになっている。以下、この進行路幅変更制

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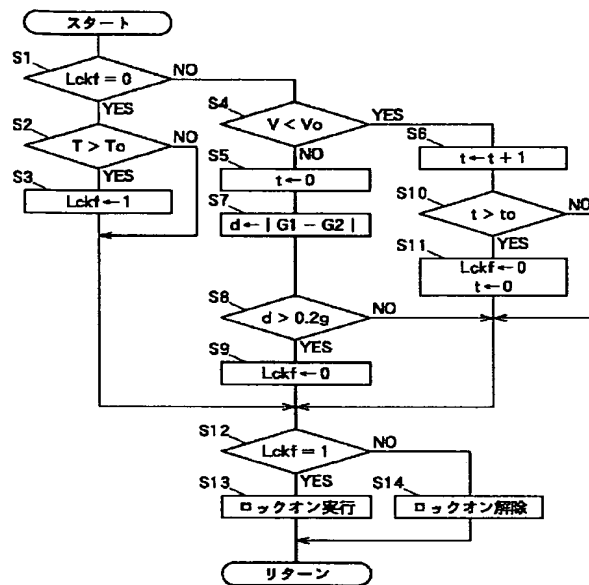
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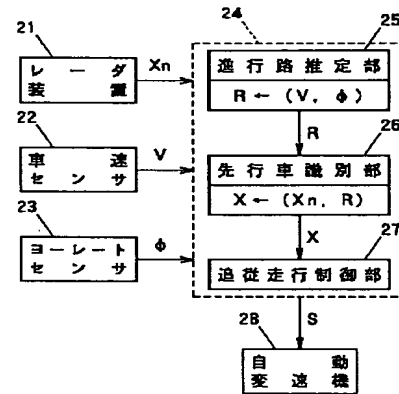
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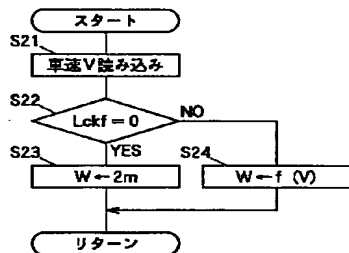
【図3】



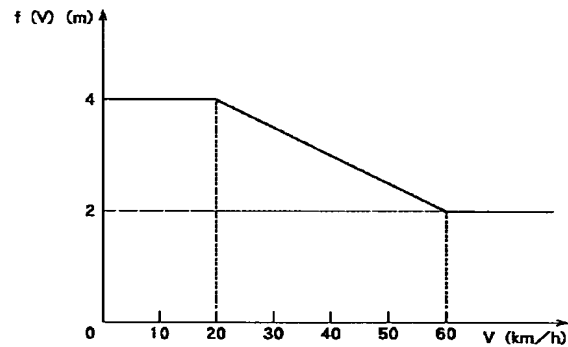
【図4】



【図5】



【図6】



フロントページの続き

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